

Pest Management Grants Final Report

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ABSTRACT

Agriculture-urban interface problems have led to an interest in adopting a reduced risk pest management program in Contra Costa County orchards. The use of pheromone mating disruption (MD) would allow apple growers to significantly reduce the use of controversial materials, however, the cost and risk of such a program has been prohibitive. The IAP program was developed to offset these factors by providing a cost share for the mating disruption product and monitoring assistance to reduce risk.

Nine orchards (172.5 acres) participated in the IAP program 1999 and eight of these orchards continued in 2000 (164 acres). Eleven additional orchards (311 acres) enrolled in a BIFS program funded by UC SAREP and adopted the IAP program's reduced risk practices this season. Three conventional orchards (105 acres) and three orchards in the 3rd year of mating disruption (72 acres) were used as comparisons to evaluate program performance. A flexible set of Reduced Risk Guidelines was developed to assist participating growers with their IPM decisions during the course of the season.

Codling moth damage in the IAP orchards averaged 3.2% and ranged from 0-8%. This is higher than the 1999 damage and resulted from unexpected, offsite migration of codling moth into some of the IAP orchards. Codling moth damage in the first year BIFS orchards ranged from 0-54% and averaged 7.2%. The highest damage occurred in a block transitioning to organic production and may be due to the lack of suitable organic supplemental controls and/or overestimation of MD product longevity. There was minimal damage from other insect or mite pests.

The use of traditional pest management materials was reduced in the IAP orchards by 36%, in the BIFS orchards by 72%, and in the Mating Disruption (MD) comparison orchards by 73%. The amount of reduced risk materials comprised 89% of all pest management materials in the IAP orchards, 93% in the BIFS orchards, and 99% in the MD comparison orchards.

The pest management costs for the IAP orchards after cost share reimbursements were \$10 more than the conventional comparison orchards. Costs for the BIFS program after the cost share reimbursements were \$56 less than this year's conventional comparison orchards.

EXECUTIVE SUMMARY

The Integrated Apple Production (IAP) project began in 1999 and continued in 2000 as an effort to reduce the use of broad-spectrum insecticides in apple orchards by encouraging the use of proven, softer IPM practices. The impetus for the project was two fold: to help growers address the potential loss of pesticides posed by the implementation of the Food Quality Protection Act (FQPA) and to reduce pesticide spray and drift problems in rapidly urbanizing eastern Contra Costa County.

Nine Integrated Apple Production (IAP) Demonstration Orchards (172.5 acres) were established in 1999 to demonstrate the integration of these soft practices into a whole orchard management approach. Eight of these orchards (164 acres) continued with the program in 2000 and served as

the template for eleven new orchards (311 acres) which adopted these practices as part of a Biologically Integrated Farming System (BIFS) project funded by UC Sustainable Agriculture Research and Education Program (SAREP). The two programs were run cooperatively sharing a Management Team, Project Coordinator, Field Scout and certain growers who enrolled acreage in both programs. Three conventional orchards (105 acres) and 3 orchards in the 3rd year of mating disruption (72 acres) were used as comparisons to evaluate program performance. The IAP and BIFS programs monitored a total of 656 acres this season. A flexible set of Reduced Risk Guidelines was developed to assist participating growers with their IPM decisions during the course of the season.

Codling moth (CM) was the primary pest and CM damage in the IAP orchards averaged 3.2% and ranged from 0 to 8 %. The BIFS orchards averaged 7.3% and ranged from 0-54%. The highest damage occurred in a block transitioning to organic production and was due to the lack of suitable organic supplemental controls and underestimation of mating disruption (MD) product longevity. Without the organic block, CM damage in the BIFS orchards averaged 2.6% and ranged from 0 to 6.3%. The damage was higher than acceptable in 8 of the 19 program orchards and, with the exception of the organic block, resulted primarily from unexpected, offsite migration into those orchards.

Secondary pest outbreaks (aphid, leafhopper, mites, leaf miner) were minimal, and successfully controlled with narrow-spectrum materials (Provado, Agri-mek, Apollo, Kelthane).

By the end of the season, the IAP orchards had reduced organophosphate (OP) use by 43% and carbamate (CB) use by 100%. This is 14% lower than the previous year. The three Mating Disruption (MD) comparison orchards reduced OP use by 83% and CB use by 100%. The BIFS orchards were able to reduce the use of organophosphates (OP) by 59% and carbamates (CB) by 92% in their first year. The use of all traditional pesticides was reduced in the IAP orchards by 36%, in the BIFS orchards by 72%, and in the and in the MD orchards by 73%. The amount of reduced risk materials (pounds of active ingredient per acre) comprised 89% of all pest management materials in the IAP orchards, 93% in the BIFS orchards, and 99% in the MD comparison orchards.

The cost for the IAP orchards was \$19/A less than their first year of transition and \$109 more than the conventional comparison orchards this year. The cost share brought average grower costs down to \$296/A, which is only \$10 more than the conventional cost. The cost of the BIFS pest management program was \$35/A more than last year's conventional program and \$56/A more than this year's conventional comparison orchards. The cost share brought costs down to \$72/A less than last year's program and \$56/A less than this year's conventional comparisons.

Information about the IAP/BIFS program and the reduced risk pest management approach has been extended to growers, pest management professionals, university researchers/educators/students and the general public.

INTRODUCTION:

Rapid urbanization around apple orchards in Contra Costa County has lead to agricultural–urban interface problems with the use of pesticides being the primary concern. The primary goal of this project is to reduce the use of controversial, broad-spectrum insecticides in apple orchards by encouraging the use of proven, softer IPM practices. The key to a softer pest management approach in apples is to adopt a mating disruption program for codling moth, the principal apple pest. Most other insect pests can be controlled by narrow spectrum and/or reduced risk materials and/or beneficial insects if the disruptive codling moth sprays are eliminated.

Pheromone mating disruption (MD) has been shown to work well in Contra Costa County as well as in other locations in California and the Northwest. It has not been as widely adopted in California as it has been in the Northwest. The primary barrier to adoption in California has been the increased cost of this approach, especially in the initial transition years, due to our longer season and higher CM pressure.

In addition to the added cost, this approach is a bit riskier, requires more intensive monitoring and is most effective on larger acreages. As a result, it has primarily been used in either organic systems or orchards where organophosphate (OP) resistance (and control failure) has been a significant concern

The IAP program was developed to offset the increased risk and expense of a MD program and provide a forum for exchange of alternative practices information. Program funds were used to provide a 50% cost share for the MD product and provide monitoring assistance. The 50% cost share was intended to bring costs of a California MD program in line with that for northwest growers.

RESULTS AND DISCUSSION:

The original objectives and tasks are listed below. Progress and accomplishments are addressed after the task list for each objective.

Objective 1: Maintain the existing IAP demonstration orchards and establish new sites

Spring-Summer 2000:

- Task 1: Publicize the program to local growers and PCAs.
- Task 2: Select additional orchards for reduced risk demonstration sites
- Task 3: Draw up Business Agreements with participating growers
- Task 4: Hire and train a Field Scout to help with monitoring

Fall and winter 2000:

- Task 5: Prepare Progress Report
- Task 6: Prepare grant proposal for continued funding of the IAP project for the final year
- Task 6: Organizes Fall IAP Workshop for local and regional growers
- Task 7: Prepare Final IAP Report
- Task 8: Prepare outreach presentations and materials

Progress and Accomplishments for Objective 1:

Local growers were informed of the IAP and BIFS programs in two local pest management meetings in the winter of 1999. In addition, personal invitations to participate in the reduced risk program were extended to local growers who had suitable acreage that was adjacent to existing mating disruption blocks, had potential for expansion, or was in a sensitive area (near homes or schools).

Due to a slight increase in the cost of the mating disruption product and the IAP funding cap, additional IAP funds were not available to enroll new orchards in the IAP program. However, additional funds were obtained from the UC Sustainable Agriculture and Education Program (UC SAREP) to support a Biologically Integrated Farming System (BIFS) Project in apples and pears in Contra Costa County. UC SAREP has committed \$140,000 over the next 3 years to expand the reduced risk program initiated by the IAP Program. The two programs have similar goals to promote reduced risk pome fruit production and will be integrated as much as possible. Both will supply a similar level of cost share and monitoring assistance and share the same Project Coordinator, Field Scout, Management Team, Advisory Team, meetings and field days.

Eleven new orchards (311 acres) and 3 new growers were accepted into the BIFS program this season which almost doubled the existing 164 IAP acres. Of the original nine IAP orchards, all but one 8-acre block continued with the program this season. This block was pulled out due to factors not related to the IAP program (age, poor production and market considerations). This grower enrolled his second apple orchard in the BIFS program this season. A map of the IAP, BIFS, MD comparison and all other apple and pear orchards in Contra Costa Co. is included in the Appendix (Figure 1). Table 1 outlines the acreage and primary codling moth control program for the IAP, BIFS, MD comparison and conventional comparison orchards. The IAP orchards continued with the Isomate product. However, some of the BIFS orchards used new products, thereby expanding the demonstration value of the projects.

Business agreements were drawn up by the UC Business Office for each grower. The agreements specify the orchard and outline grower and program responsibilities. Growers purchased the MD product and submitted bills for reimbursement (50% cost share) at the end of the season to the project coordinator.

A part time Field Scout was hired to assist with the monitoring and data entry for both the IAP and BIFS program. This was the same, well-qualified person who had done the monitoring in 1999. Unfortunately, she moved out of state in mid July due to a family job transfer. A second Field Scout was hired in mid June and trained by the existing Field Scout before she left. This scout developed transportation difficulties in getting to the orchards and was dissatisfied with the low wage and part time nature of the position and left unexpectedly in mid August to accept another position. A third scout was reassigned from another project to help finish the last 6 weeks of the IAP/BIFS field season. This scout was only available for half the time needed, so the project coordinator shared the routine trap monitoring duties and put off the pesticide use reports and analysis until the field season was over and the third scout could devote more time to data entry (October-December).

Although, there have been a number of changes in project staffing, the budget is close to the original projection. The over expenditures in June (having 2 field scouts on the payroll during the June training period) were balanced out by being short staffed for the last 6 weeks of the field season. In order to make the Field Scout position more attractive to a qualified person and to meet the increased cost of living expenses in the SF Bay area, UC SAREP has increased the BIFS funding to support a full time position at a slightly higher pay rate (in conjunction with the existing IAP budget).

The grant proposal for the final year of IAP funding was prepared and submitted October 6th.

Five IAP/BIFS Management Team/grower meetings were held this season to update growers on project progress and focus on related issues. The meeting agendas and participants are included in Table 2.

The Fall Workshop was rescheduled for the winter months in order for the project coordinator to complete the field season and prepare reports and proposals for both the IAP and BIFS projects. In an effort to extend project results and information beyond Contra Costa County, we wanted to hold the workshop in San Joaquin or Stanislaus County. As the Mid Valley Apple Association typically holds an annual Apple Symposium for growers in the No. San Joaquin Valley, the project coordinator made arrangements to present a project results at that meeting on February 27, rather than hold a separate workshop. This IAP/BIFS presentation will be coupled with a PCA panel discussion on Mating Disruption. This should extend project information to 100-150 No. San Joaquin County apple growers and also afford the opportunity to develop a mailing list of interested growers outside the project county for next season's field demonstrations. The meeting announcement/agenda is included in the Appendix after Table 2.

A poster presentation on the performance of one of the newer Mating Disruption products used this season (Paramount Aerosol Pheromone Dispensers) was presented at the annual conference of the California Association of Pest Control Advisors (CAPCA) on October 22-24. Over 1000 pest management professionals attend this conference. This new product was quite successful, adaptable to varying orchard conditions, less expensive than other MD products and is likely to be more widely adopted. Two IAP/BIFS growers intend to expand their reduced risk acreage using this product (without the aid of a cost share) due to this year's success. The poster abstract is included in the Appendix.

Two presentations were made updating local growers on the IAP/BIFS projects and results at the annual Contra Costa County Pest Management Meetings on December 9 and 21, 2000 in Brentwood. Seventy growers attended. A meeting announcement/agenda for these meetings is included in the Appendix.

Objective 2: Establish an area-wide approach to codling moth control using Mating Disruption

Spring and Summer 2000:

- Task 1: Develop a monitoring plan and a rapid communication method to share data

- Task 2: Monitor CM traps weekly, enter data into computer, provide copies to participating grower and PCAs.
- Task 3: Inspect fruit for codling moth damage at the end of each generation and at harvest.

Progress and Accomplishments for Objective 2:

Arrangements were made with each participating grower and PCA at the beginning of the season as to trap type and placement preferences, trapping schedules, and data transfer to assure that they could make the most use from the monitoring data. Traps were put out at a rate of one trap for every 3.6 acres with about ¼ of these traps using high load lures to track flights and ¾ of them using low load lures to detect problems with control. Both Bio Lure and Trece traps/lures were used depending on grower preference. It took 2 full days each week (Thursday and Friday) for the Field Scout to check and service the traps. Trap counts were faxed or dropped off to growers/ PCAs on Friday or the following Monday after computer entry. Any apparent problems were noted at that time. Trap counts are included in Figures 2A, 2B, and 2C.

Codling moth surveys were done at the end of the first and second generation and just before harvest. The Project Coordinator, the project Field Scout, another UC field scout and three trained volunteers conducted the surveys. One thousand to 2000 fruit were examined per orchard and damaged fruit cut open to determine the timing of the damage to assist with management decisions for the next generation. The codling moth damage counts are included in Tables 3A, 3B, 3C, and 3D. After each survey, a map showing the location of the damage and the traps with their counts in each orchard was prepared to help project personnel, growers and PCAs get a better idea of how trap data translates into damage.

Codling moth damage in the IAP orchards ranged from 0 to 8.4% in the IAP orchards and averaged 3.2% damage. This is higher than last years 1% average. All the IAP orchards continued using the Isomate MD product as the primary CM control. Supplemental sprays were applied as needed to take care of problems. This season there were a surprising number of problem spots; most of these can be attributed to populations moving into the IAP orchards from off site.

- The Lopez/Chavez/Garrels block had an unexpected population move in from an adjacent orchard which had been removed. Trap counts did not indicate a problem but moderate damage (1.4%) was evident in the Little Garrels orchard after the second generation. No supplemental spray was applied and the 3rd generation moved north into the Lopez/Chavez pieces causing significant preharvest damage in all 3 orchards.
- A similar situation occurred in the Rosie/Jacuzzi block where high trap counts were attributed to an adjacent orchard that had been recently removed. The Rosie and Jacuzzi Flat orchards were sprayed with an OP and damage was prevented; the Rosie and Jacuzzi Hill orchards were transitioning to organic production and applied several sprays of Surround, a less effective CM material, and received 10-13% damage.
- The Airdrome orchard had very low pressure last year but had CM moved into the BIFS pears from a neighboring orchard that had been removed. The BIFS pear block applied 2 OP sprays to address the high trap counts and used a single Checkmate MD application which lasted through the harvest in late July. The pears had minimal damage but the CM population

continued to build on pears left in the orchard after harvest and moved into the IAP apple block to cause late season damage. A border spray or a full season product is being considered for the pears next season.

- Both the Eden Plains and Delta orchards had a 1.6-1.8% damage by the end of 1999 and did not apply a supplemental first flight cover spray. Damage was evident from the first flight and a supplemental spray was applied for the second flight keeping the population under control. A first flight cover spray with a soft material (Confirm, Success) may prevent this problem in 2001.
- Last year the Neroly orchard had high CM pressure, received supplemental OP sprays for each flight and still had as much as 2.6% damage. This season the orchard received 1 well-timed supplemental OP spray for the first flight and had minimal damage at harvest.

Two important lessons have been learned from these experiences – to be on guard against populations coming from adjacent blocks and to apply a supplemental spray once damage approaches 1% .

The BIFS orchards had CM damage that ranged from 0 to 54% averaging 7.2% damage. They employed 4 different pheromone based products. All the first year MD orchards applied a first generation OP cover spray except for the organic orchard noted below. Additional sprays were applied in some orchards, based on monitoring, as noted below.

- The Geddes, Moffat and Stonebarger orchards used Isomate. The first 2 orchards had higher pressure and sustained 6-10% damage by season's end even with an additional supplemental spray for the 2nd generation. The third orchard had very low pressure and no damage.
- The 2 Preston orchards used Paramount Aerosol Pheromone Dispensers and sustained almost no damage by season's end. There is much interest in expanding the use of this product as application is easy, they last all season, they are more economical than other products, and they performed very well this season.
- Three orchards used Checkmate CM XL-1000, a new long-lived dispenser that was expected to be effective for 120-150 days. The 2 pear blocks applied a 2nd supplemental spray to address high trap counts (from a neighboring orchard), harvested within 120-130 days of hanging and sustained almost no damage although trap counts were building again towards harvest. The third orchard was transitioning to organic and did not apply a 1st generation OP spray. Checkmate CM XL-1000 was applied about 2 weeks after biofix and Checkmate CM-WS was applied after 130 days to cover the last 3 months of the season. One supplemental spray of Surround was used in the 2nd generation. The orchard had 8% damage after the 2nd generation and 54% damage in the pre-harvest sample. Either the new dispenser did not last as long as expected or it could not stand up to the high pressure conditions without more effective supplemental controls. Currently, Oil and Surround (a non-toxic clay which deters egg laying) are the only organically approved supplemental CM materials; both are only mildly effective and need to be applied weekly during moth flight periods to be most effective. Frequent, messy applications and the potential for phytotoxicity with oil make the organic approach a continuing challenge.
- Three orchards used Last Call, a pheromone plus permethrin "Attract and Kill" product. No overwintering flight OP spray was applied as this material is not a mating disruptant but uses the pheromone as bait to attract the male moth to a tiny toxic drop to kill it. Each application was expected to last 60 days. It performed well during the cool spring months but did not last

as long as expected during hotter weather. We began to see damage towards the end of the 2nd flight and all 3 orchards were sprayed with an OP for the 3rd flight in lieu of a Last Call application. This material shows great promise for smaller blocks that are not suitable for MD or as a supplemental control for problem spots in a MD site. It contains a very small quantity of insecticide in comparison with a spray and it is non-disruptive, as the insecticide is quite localized – just 3-4 drops per tree. More work needs to be done to calculate longevity under different climatic regimes and the effect of CM population on product success.

Objective 3: Develop a general Integrated Pest Management plan for IAP orchards
Spring and Summer 2000:

- Task 1: Develop a general IPM plan outlining reduced risk alternatives for each pest.
- Task 2: Convene regular Management Team meetings to share results, direct progress and amend the IPM plan.
- Task 3: Contact Advisory Committee members as necessary to provide input on pest management practices and decisions.
- Task 4: Develop a comparative monitoring program for key pests and beneficials

Progress and Accomplishments for Objective 3:

A set of reduced risk (RR) IPM guidelines was developed by the Project Coordinator at the beginning of the season in consultation with the pest management professionals on the Management and Advisory Teams. The guidelines were meant to be flexible and to outline RR alternatives for the various pests that participating growers were likely to encounter. The Guidelines are included in Table 4.

Table 2 includes a list of the Management Team members, participating growers and invited guests as well as a summary of the meeting dates, agendas, and attendance. The Management Team for the IAP and BIFS programs were combined for 2000 and the membership adjusted to include primarily pest management professionals. This change was done at the request of participating growers who felt these professionals were better suited to direct the program. Participants included PCAs from the No. San Joaquin Valley, the north coast, Contra Costa Co and product representatives from the western states. The Management Team met on a monthly basis. All participating growers and other PCAs who expressed interest were invited to attend. We typically had between 9 and 17 attendees. Three meetings were conducted over lunch (hosted by Wilbur-Ellis) and two were conducted in the field to look at secondary pests and new RR products. One of the field meetings was a special session conducted by Advisory Team member Walt Bentley and devoted entirely to reduced risk mite management. A final Management Team/Grower meeting is planned for March 8th, 2001 to review the results of last year's programs and to discuss plans for this season.

A monitoring program was established for key apple and pear pests in consultation with Advisory Team members and the UC IPM Guidelines. The Project Coordinator and Field Scout visited each orchard to evaluate the incidence and severity of secondary pests and the occurrence of beneficials. Summaries are included in Tables 5A and 5B. There were no significant secondary insect pest problems in any orchard. Where secondary pests were found, they were well below thresholds and predators/parasites were abundant. Of the 5 orchards that had mild,

mid summer LH populations, 4 had moderate LH populations by harvest but damage was not severe enough to treat. Only 1 orchard (which had received 2 supplemental OP sprays) needed an in season mite spray. All other orchards controlled secondary pests with soft materials or naturally occurring beneficial insects.

The pesticide use summaries for all pest management materials applied in 2000 are included in Tables 6A, 6B, 6C and 6D. Summary charts for the quantity and cost of applied materials for each system over since project inception are included in Figure 3.

The total amount of active ingredient (AI) applied increased by 37% in the IAP orchards, 472% in the MD orchards and decreased by 32% in the BIFS orchards since their last conventional year. The increase in AI in the RR orchards is due entirely to an increase in RR materials. The large increase in the MD orchards this year is due to the repeated applications of Surround in the two orchards transitioning to organic. This is applied at high rates (50 lbs/A) and essentially all the ingredients are active. The moderate increase in the IAP orchards is due to the mating disruption coupled with supplemental sprays. The decrease in the BIFS orchards were due to a less intensive thinning and management program in these orchards in an effort to reduce input costs. For the RR orchards, 83-87% of the AI was from RR materials in their first year of transition. This increased to 89-93% in the second year of transition and to 99% for the MD orchards in their third year. It was surprising to note the high percentage of RR materials used in the conventional orchards: 58- 83% of the active ingredients were from RR materials. This is primarily due to dormant oil applications that contain a high percentage of AI and are applied at a comparatively high volume.

The RR orchards have steadily decreased the amount of AI of traditional materials used as they have progressed in their transition. The amount of AI of traditional materials has dropped in the IAP orchards by 36%, in the BIFS orchards by 72% and in the MD orchards by 73%.

Organophosphate (OP) use was reduced in the IAP orchards by 43% and in the BIFS orchards by 59% in comparison with their last conventional year. The MD orchards have reduced OP use by 83% in comparison with their first mating disruption year. The reduction in the second year IAP orchards was expected to be greater; however, due to the widespread migration of CM from outside orchards, more supplemental sprays were required than originally anticipated. In addition, in an effort to reduce OP use, some orchards with persistent populations opted to use border sprays or RR (less effective) supplemental sprays, which did not adequately control the pest. Additional sprays were needed (or will be needed next season) to remedy this.

Carbamate use was reduced by 100% in the IAP and MD orchards and by 92% in the BIFS orchards. The majority of carbamate use in local apple orchards is not for insect control but for apple thinning. This drop in carbamate use is entirely due to the lack of any chemical thinning treatments applied in orchards this year. This was a cost cutting measure to deal with poor apple markets and may not be a lasting reduction.

The full cost of the IAP program in the second year was only \$19 less than for the first year and \$109 more than for the conventional comparison orchards this year. The IAP cost share reimbursement reduced the average growers cost to \$296/A which is only \$10 more than the

conventional cost. The primary reason for the high cost were additional sprays needed to control migrating populations of CM from adjacent orchards in 6 of the 8 IAP orchards.

The full cost of the BIFS program was \$35/A more than the same orchards (farmed conventionally) last year and \$56/A more than this year's conventional comparison orchards. The BIFS cost share reimbursements reduced the average growers cost to \$72/A less than last year and \$56/A less than this year's conventional comparisons. The costs for the BIFS orchards in their first year were less than for the IAP orchards in their second year. This can be attributed to three factors:

1. Less intensive management in these particular orchards this year as a cost cutting measure to deal with the poor market situation. No thinning or herbicide sprays and a reduced preventative disease program were used.
2. Choosing lower cost mating disruption products. Two orchards used the Paramount Aerosol Dispensers which were about \$45 less per acre than the Isomate product used by the IAP orchards. The two pear orchards only needed a single MD application and the Checkmate product they used was about \$25/A less than Isomate.
3. Three orchards skipped the final Last Call application and employed a traditional OP spray which was less expensive than the Last Call product.

The cost for the MD comparison orchards in their third year was \$86/A more than their second year and \$109 more than the conventional comparisons. The increase is due primarily to the transition to organic production for two of the three orchards. These orchards do not receive any cost share support.

SUMMARY AND CONCLUSIONS:

Agriculture-urban interface problems have led to an interest in adopting a reduced risk pest management program in Contra Costa County orchards. The use of pheromone mating disruption would allow apple growers to significantly reduce the use of controversial materials, however, the cost and risk of such a program has been prohibitive. The IAP program was developed to offset these factors by providing a cost share for the mating disruption product and monitoring assistance.

Eight orchards participated in the IAP program 2000 (164 acres). Eleven additional orchards (311 acres) enrolled in a BIFS program funded by UC SAREP and adopted the IAP program's reduced risk practices this season. Three conventional orchards (105 acres) and three orchards in the 3rd year of mating disruption (72 acres) were used as comparisons to evaluate program performance.

Codling moth damage in the IAP orchards averaged 3.2%. This is higher than the 1999 damage and resulted from unexpected, offsite migration of codling moth into some of the IAP orchards. Codling moth damage in the first year BIFS orchards averaged 7.2%. The highest damage occurred in a block transitioning to organic production and was likely due to the lack of suitable organic supplemental controls and/or overestimation of mating disruption product longevity.

The use of traditional pest management materials was reduced in the IAP orchards by 36%, in the BIFS orchards by 72%, and in the Mating Disruption (MD) comparison orchards by 73%. The amount of reduced risk materials comprised 89% of all pest management materials in the IAP orchards, 93% in the BIFS orchards, and 99% in the MD comparison orchards.

The pest management costs for the IAP orchards after cost share reimbursements were \$10 more than the conventional comparison orchards. Costs for the BIFS program after the cost share reimbursements were \$56 less than this year's conventional comparison orchards.

The grower interest in expanding this program is high. The amount of apple acreage in the county using mating disruption has increased to 42% as a result of these programs.

Figure 1: Apple and pear orchards in Contra Costa County

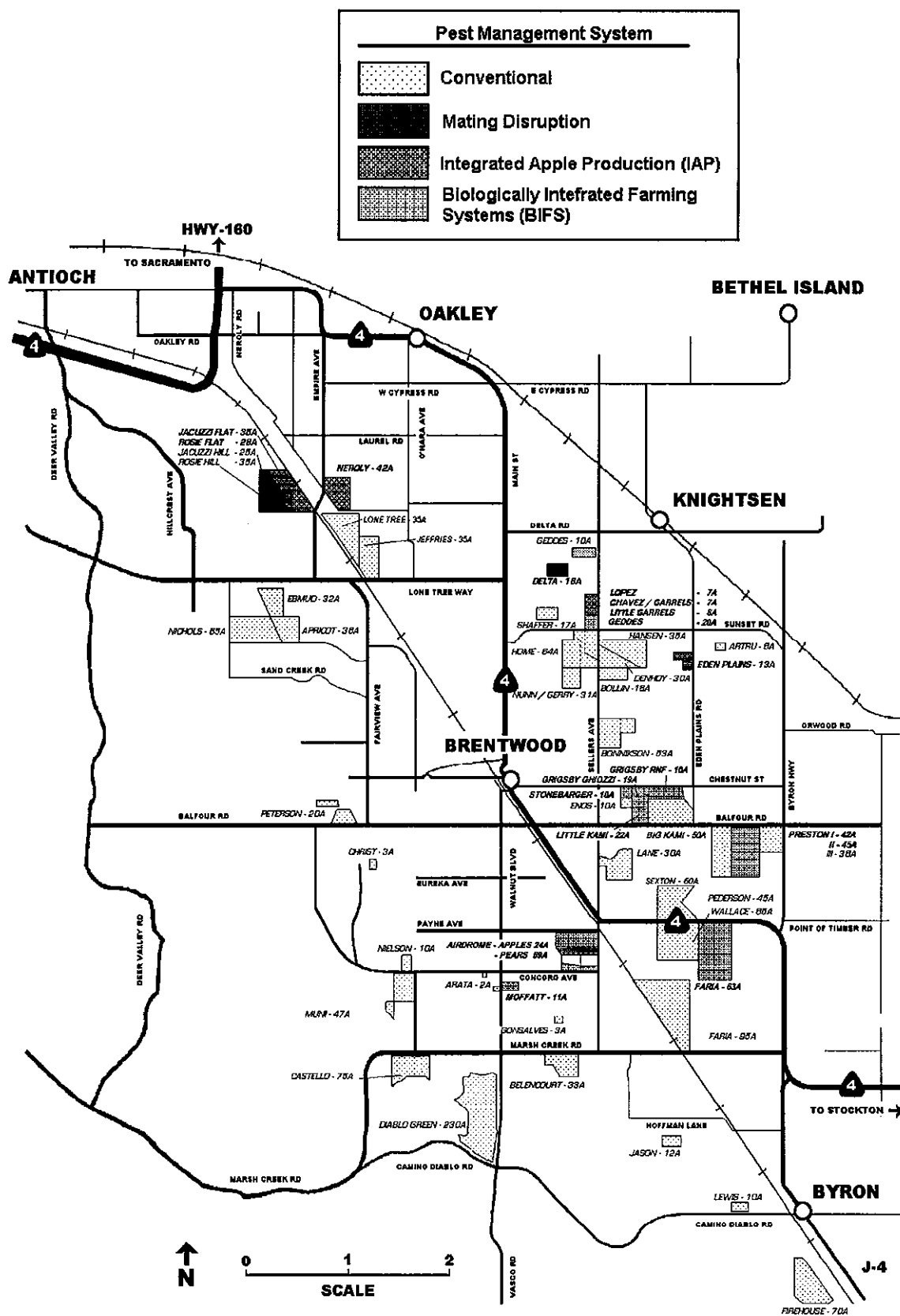


Table 1: Orchards participating in the IAP and BIFS programs and comparisons

IAP Orchards - Year 2 (IAP2)		
Orchard	Acres	Primary CM Control
Jacuzzi Flat	35	Isomate
Rosie Flat	28	Isomate
Neroly	42	Isomate
Eden Plains	13	Isomate
Lopez Garrels	7	Isomate
Chavez Garrels	7	Isomate
Little Garrels	8	Isomate
Airdrome: apples	24	Isomate
SUBTOTAL	164	
BIFS Orchards - Year 1 (BIFS1)		
Orchard	Acres	Primary CM Control
Geddes	20	Isomate
Moffat - Home	11	Isomate
Little Kami	22	Last Call
Grigsby 44	10	Last Call
Ghiozzi 44	19	Last Call
Stonebarger	10	Isomate
Preston I	42	Paramount Aerosol Pheromone Dispensers
Preston II	45	Paramount Aerosol Pheromone Dispensers
Airdrome: Bartletts	40	Checkmate
Airdrome: Bosc	29	Checkmate
Frog Hollow	63	Checkmate - Organic Transition year 1
SUBTOTAL	311	
Mating Disruption Comparison Orchards - Year 3 (MD3)		
Orchard	Acres	Primary CM Control
Jacuzzi Hill	25	Isomate - Organic Transition year 1
Rosie Hill	35	Isomate - Organic Transition year 1
Delta Rd	16	Isomate
SUBTOTAL	76	
Conventional Comparison Orchards (COMP)		
Orchard	Acres	Primary CM Control
Big Kami	50	OP Spray
Grigsby 44	10	OP Spray
Pederson	45	OP Spray
SUBTOTAL	105	
TOTAL ACRES	656	
Note: Isomate, Checkmate, and Aerosol Dispensers are mating disruption products Last Call is a pheromone based "Attract and Kill" product		

Table 2: Meetings and Field Days

DATE	AGENDA	PARTICIPANTS		
		Management Team	BIFS/IAPGrower	Guests
03-Mar	<u>Start Up Lunch Meeting #1: Caps Restaurant</u> Introductions Program Sponsors (DPR & SAREP) Program Goals Program Assistance & Administration Requirements for Participants Develop "Reduced Risk" Guidelines	Rich Bakke Janet Caprile Ginny Fornillo Jack Jenkins Elgin Martin Pat McKenzie	Richard Chavez Mark Dwelley Tony Ghiozzi Soupy Lopez Brian Mellor Walt Moffat Ron Nunn Glen Stonebarger	Dewey DeMartini (Wilbur-Ellis Co) John Heier (Wilbur-Ellis Co) Doug Reece (Wilbur-Ellis Co)
13-Apr	<u>Lunch Meeting #2: Caps Restaurant</u> Circulate Final IAP Report Collect information for Business Agreements CM Trap & Degree Day Information Pest Management Roundtable Discussion Establish meeting schedule & topics	Rich Bakke Janet Caprile Ginny Fornillo Jack Jenkins Pat McKenzie	Tony Ghiozzi Nasario Lopez Walt Moffat	Dewey DeMartini (Wilbur-Ellis Co) Doug Reece (Wilbur-Ellis Co) Max Stevenson (UC SAREP)
17-May	<u>Field Meeting # 3: Preston Orchard</u> Review trap counts, maps, DD New orchard participant – Frog Hollow Puffer demonstration & discussion Leaf Roller ID, monitoring & discussion	Rich Bakke Janet Caprile Jim Colyn Roland Gerber Jack Jenkins Pat McKenzie	Richard Chavez Tony Ghiozzi	Max Stevenson (UC SAREP)
14-Jun	<u>Lunch Meeting # 4: Caps Restaurant</u> Review 1st generation CM damage Introduce new field scout Round table discussion Set next meeting date & topic	Rich Baake Janet Caprile Jack Jenkins Pat McKenzie Wendi Wilkinson	Elgin Martin Walt Moffat Ron Nunn	Dewey DeMartini (Wilbur-Ellis Co) Doug Reece (Wilbur-Ellis Co)
26-Jul	<u>Field Meeting # 5: Wilbur-Ellis & Kami/Grigsby</u> <i>Guest Speaker: Walt Bentley</i> Mite & predator ID Mite sampling techniques Treatment thresholds Soft mite management approaches 2nd generation CM damage	Rich Bakke Janet Caprile Jim Colyn Roland Gerber Pat McKenzie Wendi Wilkinson		Walt Bentley (UCCE Adv. Team) Doug Reece (Wilbur-Ellis Co) Max Stevenson (UC SAREP)

CROP CURRENTS

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Office Hours: Mondays 1:30-4:30

CENTRAL CALIFORNIA APPLE SYMPOSIUM

February 27, 2001

Stockton Inn, Highway 99 and Waterloo Road, Stockton

Sponsored by Mid-Valley Apple Association and University of California Cooperative Extension

- 8:30 am **Registration & Coffee**
- 9:00 am **Codling Moth Pheromone Mating Disruption in Apples**
- ***Integrated Apple Production Projects in Contra Costa County***
Janet Caprile, UC Farm Advisor, Contra Costa County
 - ***Making Mating Disruption Work***
Jim Colyn, Mid Valley Agricultural Services
Pat McKenzie, Wilbur-Ellis Company
Mike Devencenzi, Agricultural Consultant
- 10:00 am **Crop Insurance Update for Apple Growers**
Alan Cheney
- 10:15 am **Red Gala Strain Update**
Janet Caprile
- 10:40 am **Break**
- 11:00 am **Overhead Cooling: Nuts & Bolts**
Steve Chinchio, C & S Orchards
Derk Van Konynenburg, Britton Van Konynenburg Partners
Niel Johnson, Prima Frutta Packing Co.
- 11:40 am **Proposed Extra Fancy Grade for Gala, Fuji, & Pink Lady**
Jeff Colombini, Lodi Farming, Inc.
- 12:00 pm **LUNCH**
- Promotional Efforts of the California Apple Promotion Group**
Chris Zanobini, California Apple Promotion Group
Robin Lucky, Robin J. Lucky & Associates

Diamond Apple Award Presentation

1 hour continuing education credit pending (category: other)

CENTRAL CALIFORNIA APPLE SYMPOSIUM RESERVATION

Please return by Feb. 23rd

attending _____

Name: _____	\$ _____	2001 Membership Dues, \$35
Address: _____	\$ _____	MVAA Member Lunch, \$7
_____	\$ _____	Non-Member Lunch, \$12
Send to: MVAA	\$ _____	Total Enclosed
6001 Maze Boulevard,		
Modesto CA 953		

Paramount Aerosol Pheromone Dispensers Control Codling Moth in Apples

Janet Caprile¹ and Pat McKenzie²

Introduction: Codling moth (*Cydia pomonella*) is a major pest of apples throughout the U.S. With the regulatory loss of traditional codling moth control materials (PennCap, Lorsban), there has been much interest in finding effective and economical alternative controls. Pheromone mating disruption is one of the most promising new techniques but it can be more costly than traditional programs. The Paramount Aerosol Pheromone Dispenser (PAPD) is a promising new mating disruption product. The cost and effectiveness of the PAPD was evaluated during the 2000 season in a 90-acre apple orchard in the Northern San Joaquin Valley (Brentwood). The project was funded by the UC Sustainable Agriculture Research and Education Program as part of their Biologically Integrated Farming System (BIFS) project.

Materials and Methods: Dispensers were assembled, programmed and hung in the upper canopy of the trees every 50-70 feet along the perimeter of the two orchard blocks shortly after biofix. This amounted to a rate of 1.5 dispensers per acre. Dispensers were programmed to emit a "puff" of pheromone every 15 minutes from 3 PM to 3 AM every day. The codling moth activity was monitored weekly with pheromone traps and after each generation by surveying fruit damage. A first generation Imidan spray was applied in late April to reduce the overwintering population. No other insect sprays were applied throughout the season. Trap counts, damage, and cost were compared to a similar, adjacent block of apples which was upwind of the mating disruption blocks and farmed using a conventional spray program. This conventional block applied 4 insect sprays during the course of the season.

Results:

Trap Catches: Trap catches dropped off dramatically in the PAPD blocks after application. An average of 4 moths were caught in the 12 standard lure traps (Trece L2 lures) and an average of 2 moths were caught in the 4 supercharged lure traps (Trece MegaLures) over the entire season after application. This is a good indication that the aerosol dispensers were successfully disrupting mating. The previous season these blocks were under a conventional spray program and caught an average of 159 moths per season, indicating a light to moderate codling moth population going into the 2000 season.

The conventional block immediately upwind of the PAPD blocks had a seasonal trap count of 99 moths in 2000 as compared to 250 moths in 1999 (prior to PAPD). This indicates that the PAPD in the adjacent block provided some suppression of the moderate codling moth population in this block. The traps in the conventional block immediately downwind of the PAPD blocks were completely shut down catching an average of .5 moths for the entire 2000 season.

Fruit Damage: At the end of the season, the PAPD blocks had .03% codling moth damage (1 strike/3360 fruit) and the upwind conventional block had .6% damage (8 strikes, 1260 fruit)

Cost: The cost of all pest management materials, labor and fuel for the PAPD blocks was \$334/A as compared to \$280 for the upwind conventional block. Next season, the PAPD costs will be reduced by \$60/A as the programmable dispenser cabinets purchased in 2000 can be reused. The only cost for the next 8-10 years will be replacing the aerosol pheromone can each season (currently \$80/can).

Conclusions: The PAPD was more effective than and cost competitive with the conventional pest management program. The PAPD has the additional advantage in being the only mating disruption product available in California that can provide season long control with one application.

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Contra Costa County Pest Management Meeting

Saturday, December 9 AND Thursday, December 21

7:30 – 11:30 am

**Delta Community Services Center
730 Third St., Brentwood**

- 7:30 Registration and Refreshments**
- 8:00 Preparing for your annual headquarters inspection**
Patty Whitlock, CCC Agriculture Dept.
- 8:30 Ground Squirrel Control**
Gene Mangini, CCC Agriculture Dept
- 8:50 Ground Water Protection Proposals**
Larry Yost, CCC Agriculture Dept
- 9:20 BREAK**
- 9:30 Application inspection procedures**
Jorge Vargas, CCC Agriculture Dept
- 9:45 Integrated Pome Fruit Production Program**
Janet Caprile, UC Cooperative Extension
- 10:10 Corn Earworm Monitoring**
Janet Caprile, UC Cooperative Extension
- 10:30 GWSS – Garin Ranch Update**
Ed Meyer, CCC Agriculture Commissioner

3 hours of Continuing Education credit for Private Applicators, PCAs, QALs, QACs, Pilots

Private Applicators whose last names begin with A-H will need to renew their certification card for the 2001 season. If you have not completed 6 hours of Continuing Education during the last 3 years you may renew by examination.

Figure 2A: Trap counts for the IAP orchards in 2000, their second season.

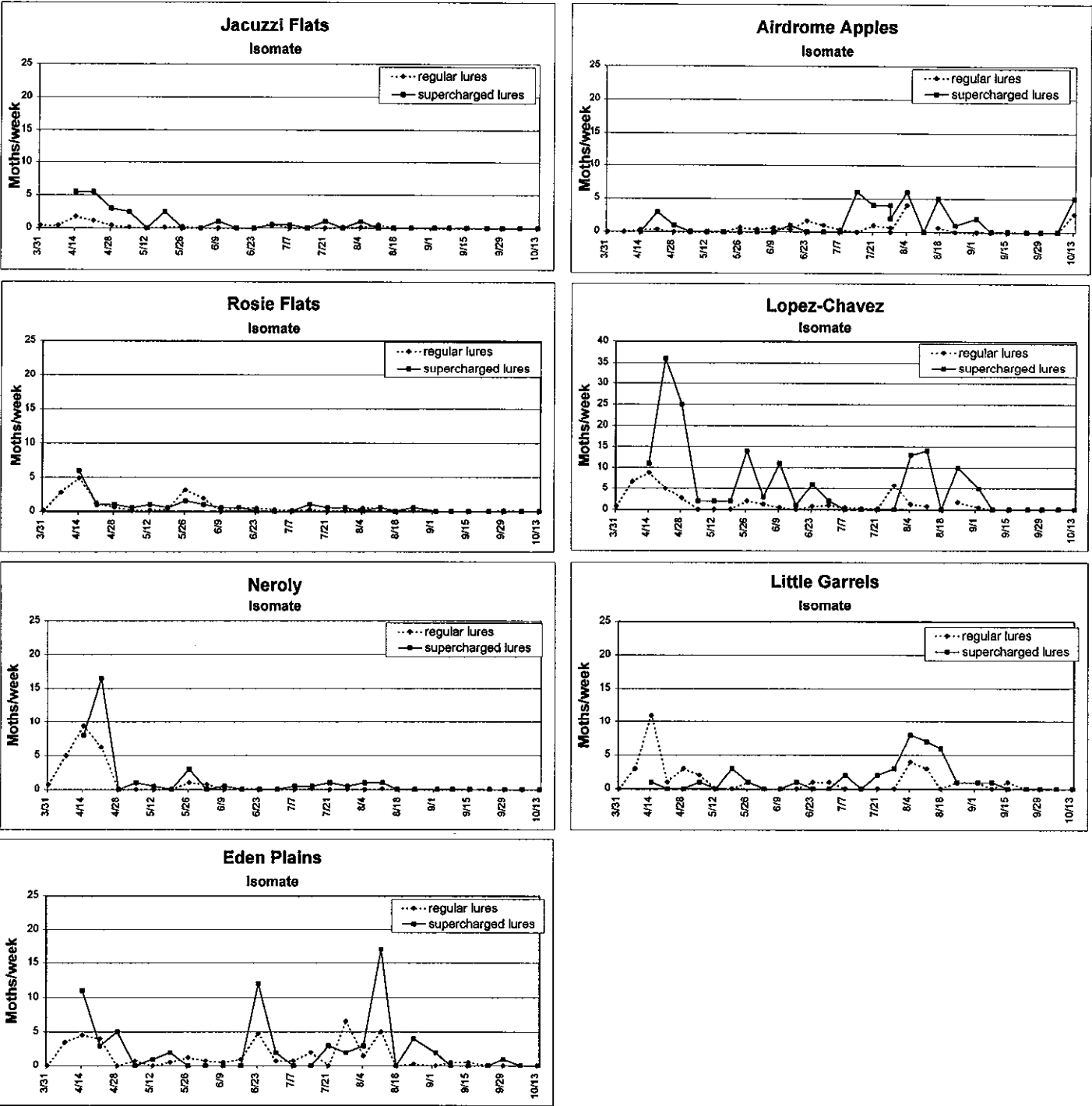


Figure 2B: Trap counts for the BIFS orchards in 2000, their first season.

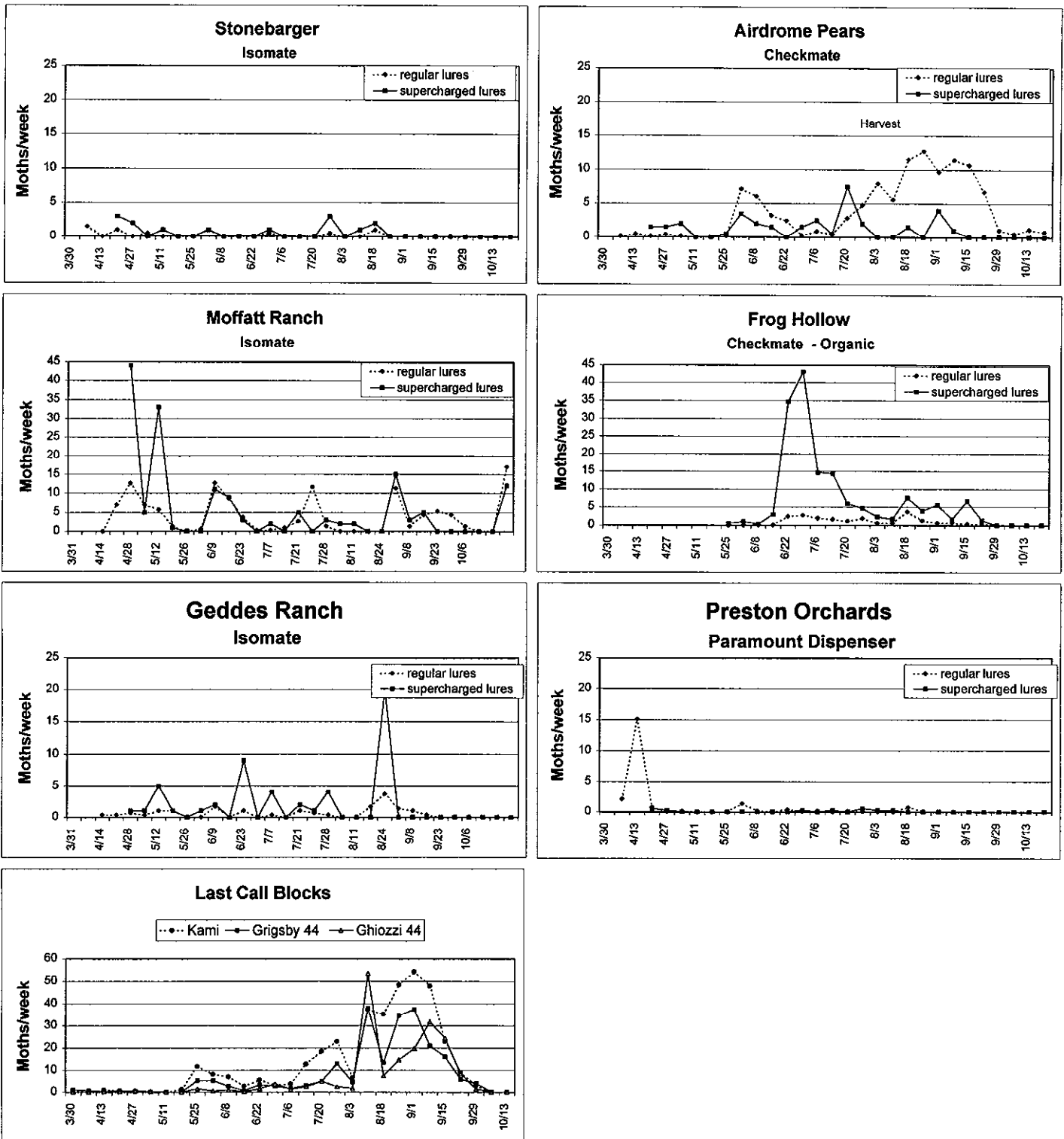


Figure 2C: Trap counts for the Mating Disruption (year 3) and Conventional Comparison orchards in 2000.

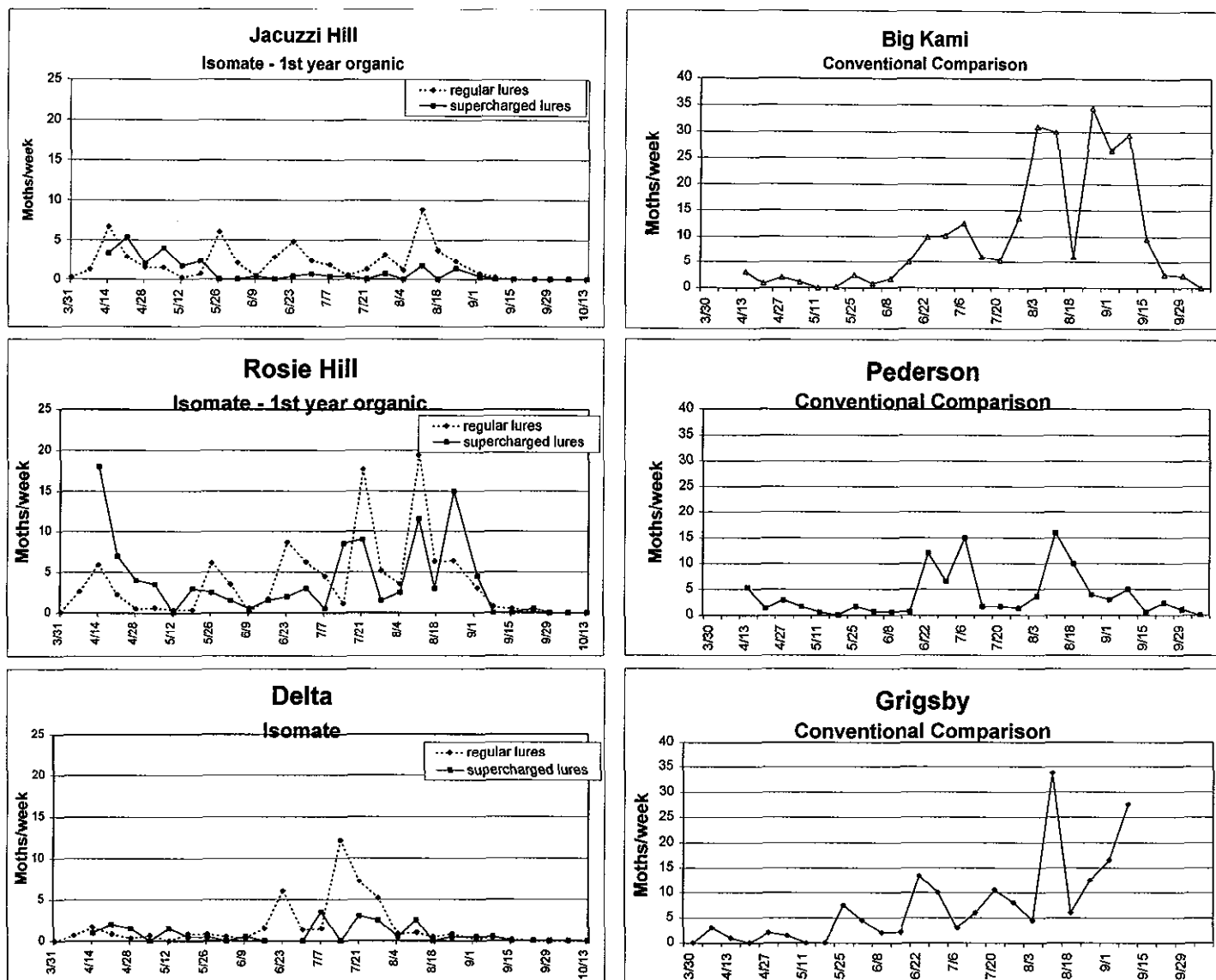


Table 3A: Codling moth damage, trap counts and management summaries for the IAP orchards in their second season.

IAP Orchards (Year 2)	Acres	CM Control 2000		Trap Counts 2000				CM Damage 2000			
		Pheromone Product	Supplemental Sprays	1st Gen	2nd Gen	3rd Gen	TOTAL	1st Gen	2nd Gen	3rd Gen	TOTAL
Jacuzzi Flat	35	4/1 Isomate 350/A 7/1 Isomate 300/A	4/18 1A: Guthion - full 6/17 1B/2A: Guthion - edge	4.5	0.9	0.5	5.9	0.1	0.2	0.0	0.1
Rosie Flat	28	4/1 Isomate 350/A 7/1 Isomate 300/A	4/18 1A: Guthion - full 6/17 1B/2A: Guthion - edge 8/17 3A: Guthion - edge	15.1	2.1	0.8	18.0	0.1	0.0	0.0	0.0
Neroly	42	3/31 Isomate 400/A 7/1 Isomate 400/A	4/22 1A: Guthion - full 6/15 1B/2A: Guthion - edge	23.1	0.4	0.1	23.6	0.1	0.1	0.4	0.3
Eden Plains	13	4/1 Isomate 400/A 7/9 Isomate 300/A	6/24 2A: Guthion - full	15.8	17.3	6.3	39.3	1.7	1.6	0.0	1.5
Lopez Garrels	7	4/1 Isomate 400/A 7/1 Isomate 400/A	4/14 1A: Guthion - full 6/15 2A: Confirm - full 7/28 2B: Guthion - edge	27.5	9.0	4.0	40.5	0.0	0.2	5.2	5.4
Chavez Garrels	7	4/1 Isomate 400/A 7/1 Isomate 400/A	4/14 1A: Guthion - full 6/15 2A: Confirm - full 7/28 2B: Guthion - edge	28.0	10.5	2.0	40.5	0.6	0.2	4.8	5.2
Little Garrels	8	4/1 Isomate 350/A 7/1 Isomate 300/A	4/18 1A: Guthion - full 7/28 2B: Guthion - edge	21.0	6.0	6.0	33.0	0.4	1.4	6.6	8.4
Airdrome: Apples	24	4/4 Isomate 400/A 7/5 Isomate 250/A	6/14 1B/2A: Guthion - edge	2.7	4.7	4.7	12.0	0.1	0.2	3.9	4.2
IAP AVERAGE DAMAGE								0.4	0.5	2.6	3.1

NOTES (4A-D): 1st generation Biofix = 4/1/00; damage counts taken 6/5 - 6/12 (872-977 DD)
 2nd generation Biofix = 6/15/00; damage counts taken 7/25 - 7/31 (776-920 DD)
 3rd generation Biofix = 8/5/00; pre-harvest damage counts taken 9/5 - 9/11 (562-687 DD)
 Trap counts are cumulative averages of all 1 x load traps in the orchard over each flight

Table 3B: Codling moth damage, trap counts and management summaries for the BIFS orchards in their first season.

BIFS Orchards (Year 1)	Acres	CM Control 2000		Trap Counts 2000				CM Damage 2000			
		Pheromone Product	Supplemental Sprays	1st Gen	2nd Gen	3rd Gen	TOTAL	1st Gen	2nd Gen	3rd Gen	TOTAL
Geddes	20	4/2 Isomate 400/A 7/8 Isomate 250/A	4/12 1A: Guthion - full 8/18 3A: Guthion - edge	6.3	4.0	6.3	16.7	0.0	0.9	4.6	5.9
Moffat - Home	11	4/3 Isomate 400/A 7/5 Isomate 400/A	4/29 1A: Guthion - full 6/8 1B/2A: Guthion - full	59.3	17.0	28.0	104.3	0.6	1.1	8.0	10.0
Little Kami	22	4/2 Last Call 5/19 Last Call 7/6 Last Call	4/18 1A: Guthion - edge 8/9 3A: Imidan - full	33.8	73.5	232.0	339.3	0.1	2.3	1.1	3.5
Grigsby 44	10	4/2 Last Call 5/19 Last Call 7/6 Last Call	4/18 1A: Guthion - edge 8/9 3A: Imidan - full	17.0	33.3	153.0	203.3	0.0	0.2	0.3	0.5
Ghiozzi 44	19	4/2 Last Call 5/19 Last Call 7/6 Last Call	4/18 1A: Guthion - edge 9/9 3A Gen: Imidan - full 9/8 3B Gen: Sevin - full	4.8	18.3	124.3	147.3	0.1	1.4	4.8	6.3
Stonebarger	10	4/2 Isomate 400/A 7/8 Isomate 250/A	4/10 1A: Imidan - full	4.0	1.0	1.0	6.0	0.0	0.1	0.0	0.0
Preston I	42	4/12 Puffers	4/15 1A: Imidan - full	33.0	0.8	1.0	34.8	0.0	0.0	0.1	0.1
Preston II	45	4/12 Puffers	4/15 1A: Imidan - full	6.7	0.0	0.7	7.3	0.0	0.1	0.0	0.0
Airdrome: Bartletts	40	4/4 Checkmate	4/25 1A: Guthion - full 6/14 1B: Guthion - full	32.9	32.6	66.6	132.0	0.1	0.1		0.1
Airdrome: Bosc	29	4/4 Checkmate	4/14 1A: Guthion - full	4.7	5.0	51.8	61.5	0.0	0.0		0.0
Frog Hollow	63	4/5 Checkmate 7/21 Checkmate 9/1 Checkmate	6/19 2A: Surround/oil	2.6	10.7	6.7	20.0	0.6	7.7	45.7	54.0
BIFS AVERAGE DAMAGE								0.1	1.3	7.2	7.3

Table 3C: Codling moth damage, trap counts and management summaries for the Mating Disruption Comparison orchards in their third season.

MD Comparison Orchards (Year 3)	Acres	CM Control 2000		Trap Counts 2000				CM Damage 2000			
		Pheromone Product	Supplemental Sprays	1st Gen	2nd Gen	3rd Gen	TOTAL	1st Gen	2nd Gen	3rd Gen	TOTAL
Jacuzzi Hill	25	4/1 Isomate 400/A 7/1 Isomate 400/A	6/21 2A:Surround/oil 6/28 2A:Surround/oil 7/12 2B:Surround/oil 7/19 2B:Surround/oil	23.1	17.6	15.6	56.2	0.7	6.2	7.3	13.5
Rosie Hill	35	4/1 Isomate 400/A 7/1 Isomate 400/A	6/21 2A:Surround/oil 6/28 2A:Surround/oil 7/12 2B:Surround/oil 7/19 2B:Surround/oil	22.5	48.3	35.6	106.4	0.9	4.6	5.7	10.3
Delta Rd	16	4/1 Isomate 400/A 7/9 Isomate 300/A	4/16 1A: Imidan -edge 6/22 2A: Confirm - full 6/22 2A: Guthion - edge	6.7	30.7	3.2	40.5	0.6	0.7	1.1	1.8
MD COMPARISON AVERAGE DAMAGE								0.7	3.8	4.7	8.5

Table 4D: Codling moth damage, trap counts and management summaries for the Conventional Comparison orchards for 2000.

Conventional Comparison Orchards	Acres	CM Control 2000		Trap Counts 2000				CM Damage 2000			
		Pheromone Product	Supplemental Sprays	1st Gen	2nd Gen	3rd Gen	TOTAL	1st Gen	2nd Gen	3rd Gen	TOTAL
Big Kami	50	NONE	4/16 1A: Guthion - full 6/10 2A Gen: Confirm - full 7/15 2B: Guthion - full 8/9 3A: Imidan - full	10.9	87.4	140.6	238.9	0.2	1.6	1.1	2.7
Grigsby 44	10	NONE	1st Gen: Guthion - full 1B Gen: Confirm - full 2nd Gen: Guthion - full 3rd Gen: Imidan - full	24.0	48.5	101.0	173.5	0.1	1.0	1.7	2.7
Pederson	45	NONE	4/19 1A: Imidan - full 6/1 1B: Guthion - full 7/8 2B: Confirm - full 8/18 3A: Guthion - full	14.3	39.7	42.0	96.0				0.6
CONVENTIONAL COMPARISON AVERAGE DAMAGE								0.2	1.3	1.4	2.0

Table 4: Reduced Risk (RR) IPM Guidelines

Pest/Problem	Control Strategy
Codling Moth	<p>Mating Disruption or Last Call with supplemental sprays, as needed Supplemental OP sprays: Imidan, Guthion, Lorsban, Diazinon Supplemental RR controls: Confirm, Success, Surround, Oil, Last Call</p> <p>1st year: full rate MD/Last Call 1st generation OP spray 2nd & 3rd generation: full or edge or no spray - based on monitoring OP or RR material - based on monitoring</p> <p>2nd year: full to slightly reduced rate of MD - depending on pressure 1st generation: full or edge or no spray - based on monitoring OP or RR - based on monitoring 2nd & 3rd generation: full or edge or no spray - based on monitoring OP or RR material - based on monitoring</p> <p>3rd year: full to reduced rate of MD - depending on pressure 1st generation: full or edge or no spray - based on monitoring OP or RR - based on monitoring 2nd & 3rd generation: full or edge or no spray - based on monitoring OP or RR material - based on monitoring</p> <p>Mastus releases in fall once broad spectrum materials have been minimized</p>
Pear Psylla	dormant oil in season oil, Provado, Agrimek
Leaf Rollers	BT, Confirm, or Success if monitoring indicates a problem
Leaf Miner	preventative Agrimek spray with 1st CM OP spray naturally occurring beneficials will control once broad spectrum materials are minimized
Mites	preventative Agrimek, Apollo spray with OP sprays oil for in season populations if monitoring for pests & beneficials indicates a problem naturally occurring beneficials may control once broad spectrum materials are minimized
Aphid	Provado, oil, soap if monitoring for pests & beneficials indicates a problem
Leaf Hopper	Provado if monitoring indicates a problem (there are some egg parasites but little is known about the beneficials which control LH)
Scale	dormant oil

Table 5A: The incidence of secondary apple and pear pests and beneficial insects

APPLE PESTS & BENEFICIALS							
Program	Orchard	Aphids		Leaf Hopper		Leaf Miner	
		% Shoots w/ Damage	% Biological Control	% Leaves w/ Damage	Severity Rating	Mines/ Leaf	% Biological Control
BIFS1	Geddes	22	41	10	1.1	0.01	100
BIFS1	Moffat - Home	3	0	34	1.1	0	
BIFS1	Little Kami	8	12	8	1.0	0.01	100
BIFS1	Grigsby 44	2	50	1	1.0	0	
BIFS1	Ghiozzi 44	10	20	12	1.1	0.02	100
BIFS1	Stonebarger	11	0	26	1.0	0	
BIFS1	Preston I	5	20	0		0	
BIFS1	Preston II	5	0	0		0	
BIFS1	Frog Hollow	5	60	21	1.0	0.33	76
IAP2	Jacuzzi Flat	1	0	16	1.3	0.01	100
IAP2	Rosie Flat	0		21	1.0	0.02	0
IAP2	Neroly	0		5	1.0	0.46	70
IAP2	Eden Plains	0		57	1.2	0.09	100
IAP2	Lopez Garrels	0		33	1.2	0.01	100
IAP2	Chavez Garrels	6	50	38	1.0	0.04	50
IAP2	Little Garrels	7	14	23		0.25	68
MD3	Jacuzzi Hill	0		10	1.0	0.02	100
MD3	Rosie Hill	0		10	1.0	0	
MD3	Delta Rd	8	25	56	1.1	0.05	100
COMP	Big Kami						
COMP	Grigsby 44	4	0	6	1.0	0	
COMP	Pederson						

NOTES: Evaluations made on 100 terminals (aphids) and 100 basal shoots (LH, TLM) per orchard on 6/26-7/11
 Biological Control = % of infested leaves or mines showing parasitization or predation
 Severity Rating: 0=none 1=mild 2=moderate 3=severe

PEAR PESTS & BENEFICIALS						
Program	Orchard	Aphids	Psylla	Lacewing	Leaf Hopper	Leaf Miner
		% Shoots w/ Damage	nymphs/ shoot	eggs/shoot	% leaves w/ damage	mines/ leaf
BIFS1	Airdrome: Bartletts	0	3.5	1.2	0.7	0.05
BIFS1	Airdrome: Bosc	0	1.5	1.2	3.8	0.01
Program	Orchard	Rust Mite		Blister Mite		
		% Shoots w/ Damage	Severity Rating	% Shoots w/ Damage	Severity Rating	
BIFS1	Airdrome: Bartletts	44	1.4	0	0	
BIFS1	Airdrome: Bosc	0	0	46.6	1	

NOTES: Evaluations made on 20 top shoots/block on 7/11
 Severity Rating: 0=none 1=mild 2=moderate 3=severe

Table 5B: Observational rating of other damage during first generation codling moth survey

Program	Orchard	Other Damage						
		Leaf Roller	Rosy Apple Aphid	Fire Blight	Scab	San Jose Scale	Other	
BIFS1	Geddes			0				
BIFS1	Moffat	0	1	1				
BIFS1	Little Kami	2			2			
BIFS1	Grigsby - RNF				2			
BIFS1	Ghiozzi			1.5	1-4			
BIFS1	Stonebarger	1		1.5	1			
BIFS1	Preston I			1	1			
BIFS1	Preston II			1	1			
BIFS1	Frog Hollow	0	1	2	1	2		
BIFS1	Airdrome-pears	0	0	4-5	0	0	psylla	1
IAP2	Jacuzzi Flat		1	1			pruner damage	4
IAP2	Rosie Flat		1	1			pruner damage	2.5
IAP2	Neroly	1	2	1			pruner damage	1
IAP2	Eden Plains							
IAP2	Lopez							
IAP2	Chavez							
IAP2	Little Garrels							
IAP2	Airdrome-apples							
MD3	Jacuzzi Hill		1	2			pruner damage	2
MD3	Rosie Hill		1	3			pruner damage	3
MD3	Delta Rd	0	0	2				
COMP	Big Kami	2.5			1			
COMP	Grigsby - RNF				2			

Damage Rating:

1 = very little

2 = minor damage

3 = moderate damage

4 = significant damage

5 = very significant damage

Table 6A: Pest management summaries for the IAP orchards in their second season (2000)

IAP ORCHARDS	DISEASE (scab, FB, PM)	SECONDARY PEST SPRAYS						CODLING MOTH	
		Dormant	Aphid	Leaf Miner	Mite	Leaf Hopper	Leaf Roller	Supplemental Sprays	Pheromone Product
Jacuzzi Flat	3/21 Rally/Dithane 4/18 Rally 6/17 Rally	Diazinon + oil	3/21 Diazinon		6/17 Apollo			1st Gen: Guthion - full 2nd Gen: Guthion - edge	4/1 Isomate 350/A 7/1 Isomate 300/A
Rosie Flat	3/21 Rally/Dithane 4/18 Rally 6/17 Rally	Diazinon + oil	3/21 Diazinon		6/15 Apollo	8/17 Provado		1st Gen: Guthion - full 2nd Gen: Guthion - edge 3rd Gen: Guthion - edge	4/1 Isomate 350/A 7/1 Isomate 300/A
Neroly	3/21 Rally 3/21 Dithane 4/22 Rally	Diazinon + oil	3/21 Diazinon		6/17 Apollo			1st Gen: Guthion - full 2nd Gen: Guthion - edge	3/31 Isomate 400/A 7/1 Isomate 400/A
Eden Plains	3/25 Rally/Aliette 4/5 Aliette/Agrimycin	Diazinon + oil						2nd Gen: Guthion - full	4/1 Isomate 400/A 7/9 Isomate 300/A
Lopez Garrels	3/18 Rally 4/14 Rally	Diazinon + oil	3/18 Diazinon	4/14 Agrimek	4/14 Agrimek			1st Gen: Guthion - full 2nd Gen: Confirm - full 2B Gen: Guthion - edge	4/1 Isomate 400/A 7/1 Isomate 400/A
Chavez Garrels	3/18 Rally 4/14 Rally	Diazinon + oil	3/18 Diazinon	4/14 Agrimek	4/14 Agrimek			1st Gen: Guthion - full 2nd Gen: Confirm - full 2B Gen: Guthion - edge	4/1 Isomate 400/A 7/1 Isomate 400/A
Little Garrels	4/18 Rally	Diazinon + oil		4/18 Agrimek	4/18 Agrimek			1st Gen: Guthion - full 2B Gen: Guthion - edge	4/1 Isomate 350/A 7/1 Isomate 300/A
Airdrome: Apples		Diazinon + oil			7/15 Kelthane	7/15 Provado		1st Gen: Guthion - edge	4/4 Isomate 400/A 7/5 Isomate 250/A

Table 6B: Pest management summaries for the BIFS orchards in their first season (2000)

BIFS Apple ORCHARDS	DISEASE (scab, FB, PM)	SECONDARY PEST SPRAYS						CODLING MOTH	
		Dormant	Aphid	Leaf Miner	Mite	Leaf Hopper	Leaf Roller	Supplemental Sprays	Pheromone Product
Geddes		Diazinon + oil				8/18 Provado		1st Gen: Guthion - full 3rd Gen: Guthion - edge	4/2 Isomate 400/A 7/8 Isomate 250/A
Moffat - Home	4/29 Rally		4/29 Diazinon	4/29 Agrimek	4/29 Agrimek 9/1 Kelthane			1st Gen: Guthion - full 2nd Gen: Guthion - full	4/3 Isomate 400/A 7/5 Isomate 400/A
Little Kami	3/29 Rally 6/10 Rally	Diazinon + oil	3/29 Diazinon	4/18 Agrimek	4/18 Agrimek			1st Gen: Guthion - edge 6/10 Confirm 3rd Gen: Imidan - full	4/2 Last Call 5/19 Last Call 7/6 Last Call
Grigsby 44	3/28 Rally/Aliette 4/18 Rally	Diazinon + oil	3/28 Diazinon	4/18 Agrimek	4/18 Agrimek			1st Gen: Guthion - edge 3rd Gen: Imidan - full	4/2 Last Call 5/19 Last Call 7/6 Last Call
Ghiozzi 44	3/18 Rally/Aliette 4/18 Rally	Diazinon + oil	3/18 Diazinon	4/18 Agrimek	4/18 Agrimek			1st Gen: Guthion - edge 3rd Gen: Imidan - full 3B Gen: Sevin - full	4/2 Last Call 5/19 Last Call 7/6 Last Call
Stonebarger	3/28 Rally 4/10 Rally	Diazinon + oil						1st Gen: Imidan - full	4/2 Isomate 400/A 7/8 Isomate 250/A
Preston I	4/15 Rally	Diazinon + oil		4/15 Agrimek	4/15 Agrimek			1st Gen: Imidan - full	4/12 Puffers
Preston II	4/15 Rally	Diazinon + oil		4/15 Agrimek	4/15 Agrimek			1st Gen: Imidan - full	4/12 Puffers
Frog Hollow	4/24 Agrimycin							2nd Gen: Surround + oil	4/5 Checkmate 150/A 7/21 Checkmate 150/A 9/1 Checkmate 150/A

BIFS Pear ORCHARDS	DISEASE (Fire Blight)	SECONDARY PEST SPRAYS						CODLING MOTH	
		Dormant	Aphid	Leaf Miner	Mite	Leaf Hopper	Psylla	Supplemental Sprays	Pheromone Product
Airdrome: Bosc	4/18 Agrimycin	Asana + oil					4/14 Oil 6/13 Oil	1st Gen: Guthion - full	4/4 Checkmate 160/A
Airdrome: Bartlett	4/18 Agrimycin	Asana + oil					4/25 Oil 6/14 Oil	1st Gen: Guthion - full 1B/2A Gen: Guthion - full	4/4 Checkmate 160/A

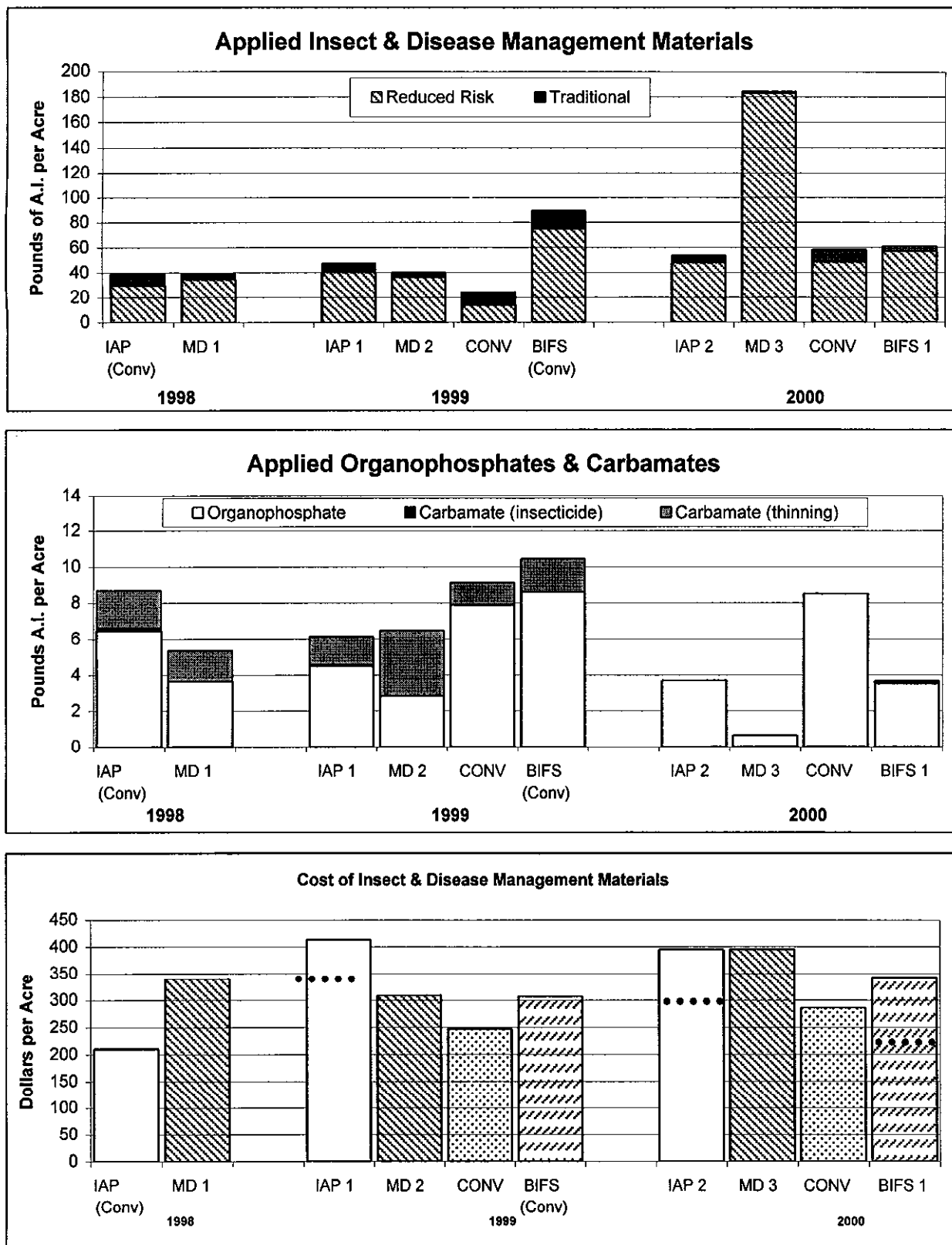
Table 6C: Pest management summaries for the Mating Disruption Comparison orchards in their third season (2000)

MD COMPARISON (Year 3)	DISEASE (scab, FB, PM)	SECONDARY PEST SPRAYS						CODLING MOTH	
		Dormant	Aphid	Leaf Miner	Mite	Leaf Hopper	Leaf Roller	Supplemental Sprays	Pheromone Product
Jacuzzi Hill								2nd Gen: Surround + oil 2nd Gen: Surround + oil 2nd Gen: Surround + oil 2nd Gen: Surround + oil	4/1 Isomate 400/A 7/1 Isomate 400/A
Rosie Hill								2nd Gen: Surround + oil 2nd Gen: Surround + oil 2nd Gen: Surround + oil 2nd Gen: Surround + oil	4/1 Isomate 400/A 7/1 Isomate 400/A
Delta Rd	3/25 Rally/Agrimycin 4/5 Agrimycin/Aliette 4/16 Rally/Aliette	Diazinon + oil						1st Gen: Imidan - edge 2nd Gen: Confirm - full 2nd Gen: Guthion - edge	4/1 Isomate 400/A 7/9 Isomate 300/A

Table 6D: Pest management summaries for the Conventional Comparison orchards for 2000.

CONVENTIONAL COMPARISON	DISEASE (scab, FB, PM)	SECONDARY PEST SPRAYS						CODLING MOTH	
		Dormant	Aphid	Leaf Miner	Mite	Leaf Hopper	Leaf Roller	Supplemental Sprays	Pheromone Product
Big Kami	3/28 Rally 6/10 Rally	Diazinon + oil	3/28 Diazinon	4/16 Agrimek	4/16 Agrimek 8/9 Kelthane			1st Gen: Guthion - full 1B/2A Gen: Confirm - full 3rd Gen: Imidan - full	
Grigsby 44	3/28 Rally/Aliette 4/18 Rally 6/10 Rally	Diazinon + oil	3/28 Diazinon	4/18 Agrimek	4/18 Agrimek			1st Gen: Guthion - full 1B Gen: Confirm - full 2nd Gen: Guthion - full 3rd Gen: Imidan - full	
Pederson	4/19 Rally	Diazinon + oil		4/19 Agrimek	4/19 Agrimek			1st Gen: Imidan - full 1B Gen: Guthion - full 2nd Gen: Asana/Confirm - full 3rd Gen: Guthion - full	

Figure 3: Quantity and cost of applied pest management materials



1998: IAP orchards farmed conventionally, MD in first year of mating disruption

1999: IAP orchards in first year of mating disruption, MD orchards in second year of mating disruption, BIFS orchards farmed conventionally

2000: IAP orchards in second year of mating disruption, MD orchards in third year of mating disruption, BIFS orchards in first year of reduced risk